

## Claims

- [c1] 1. A method of MR data acquisition comprising:  
prescribing a 3D imaging volume;  
applying a pulse sequence that is applicable as a 3D pulse sequence with slice encoding andrewinder gradients disabled in one dimension;  
acquiring 2D MR data to localize the 3D imaging volume;  
enabling the disabled encoding andrewinder gradients in the pulse sequence;  
applying the pulse sequence in three dimensions; and  
acquiring 3D MR data of the 3D imaging volume.
- [c2] 2. The method of claim 1 further comprising the step of modifying the pulse sequence between a 2D pulse sequence and a 3D pulse sequence in real-time and on-the-fly.
- [c3] 3. The method of claim 1 further comprising the step of allowing adjustment of at least one of an FOV, a slice thickness, flip angle, matrix size, sampling bandwidth, and spatial saturation between real-time data acquisitions.
- [c4] 4. The method of claim 3 further comprising the step of acquiring full k-space data for one MR data acquisition after an adjustment, and then acquiring partial k-space data thereafter until a subsequent adjustment.
- [c5] 5. The method of claim 1 wherein the steps of acquiring 2D MR data is sped up by first acquiring one set of complete k-space data, and then acquiring a subset of k-space data thereafter.
- [c6] 6. The method of claim 1 further comprising the step of detecting object movement during real-time data acquisition and if object movement is detected, acquiring full k-space data for at least one MR data acquisition and acquiring partial k-space data thereafter.
- [c7] 7. The method of claim 6 wherein the step of detecting is performed by one of an automated detection using a navigator echo technique and manual observation of real-time generated images.
- [c8] 8. The method of claim 1 further comprising the step of switching from 2D MR

data acquisition to 3D data acquisition within one repetition time (TR).

- [c9] 9. The method of claim 1 as used in an MRA exam and further comprising:  
injecting a contrast agent;  
continuously applying the pulse sequence, acquiring 2D MR data, and displaying  
images in real-time until an arrival of the contrast agent in a monitor station;  
and then,  
switching the pulse sequence to 3D acquisition and acquiring 3D MR data for  
the prescribed 3D imaging volume.
- [c10] 10. The method of claim 9 further comprising the step of adaptively switching  
between a 2D monitor mode and a 3D acquisition mode for each of a number of  
prescribed 3D imaging volumes.
- [c11] 11. An MRI apparatus to acquire MR images and switch between 2D and 3D  
image acquisition in real-time comprising:  
a magnetic resonance imaging (MRI) system having a plurality of gradient coils  
positioned about a bore of a magnet to impress a polarizing magnetic field and  
an RF transceiver system and an RF switch controlled by a pulse module to  
transmit RF signals to an RF coil Assembly to acquire MR images; and  
a computer programmed to:  
modify a pulse sequence upon demand between a 2D pulse sequence and a 3D  
pulse sequence;  
apply the pulse sequence and acquire MR image data in 2D and 3D based on the  
pulse sequence as modified on demand; and  
reconstruct MR images.
- [c12] 12. The MRI apparatus of claim 11 further comprising a user input to select the  
modification of the pulse sequence and wherein the modification is made within  
one repetition time of the pulse sequence.
- [c13] 13. The MRI apparatus of claim 11 wherein the pulse sequence is a conventional  
3D pulse sequence when in a 3D pulse sequence mode and has the slice  
encoding and rewinder gradients disabled in a 2D pulse sequence mode.
- [c14] 14. The MRI apparatus of claim 11 further comprising a user input to adjust at



- [c21] 21. The computer program of claim 20 that further causes the computer to acquire full k-space data for one MR data acquisition after an adjustment, and then acquire partial k-space data thereafter until a subsequent adjustment.
- [c22] 22. The computer program of claim 18 that further causes the computer to detect object movement during real-time data acquisition and if object movement is detected, acquire full k-space data for at least one MR data acquisition and acquire partial k-space data thereafter.
- [c23] 23. The computer program of claim 19 that further causes the computer to accelerate data acquisition by first acquiring one set of complete k-space data, and then acquire a subset of k-space data thereafter.
- [c24] 24. The computer program of claim 18 that further causes the computer to convert the common pulse sequence from 3D to 2D within a single repetition time.
- [c25] 25. A method of acquiring MR images in a 3D MRI study comprising the steps of:  
 identifying a desired imaging volume;  
 entering a real-time monitoring mode using a modifiable pulse sequence in a 2D mode;  
 navigating in real-time by acquiring and monitoring 2D images until the desired imaging volume is sufficiently located;  
 switching the modifiable pulse sequence from the 2D mode to a 3D mode; and  
 acquiring 3D images of the desired imaging volume.
- [c26] 26. The method of claim 25 wherein the modifiable pulse sequence is switched from one mode to another within a single repetition time.
- [c27] 27. The method of claim 25 further comprising the steps of:  
 switching the modifiable pulse sequence from 3D to 2D after imaging the desired imaging volume;  
 allowing for further navigating; and  
 switching the modifiable pulse sequence to 3D and acquiring further 3D images.